IN THE CLAIMS:

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with <u>underlining</u> and deleted text with ~~strikethrough~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered).

Please AMEND claims 1 and 11 in accordance with the following:

1.   (Currently Amended) A cubic convolution interpolating apparatus comprising:

an image signal divider dividing an image signal into a plurality of subblocks once as original image data; and

a generating unit generating parameters which determine cubic convolution interpolation coefficients in units of the once divided subblocks, and performing cubic convolution interpolation on the original image data that is transmitted from the image signal divider<u>,</u>

<u>wherein the generating unit comprises:</u>

<u>a forward scaling processor sampling a cubic convolution interpolated continuous function of the original image data transmitted from the image signal divider using a first scaling factor and scaling the original image data;</u>

<u>a backward scaling processor sampling a backward cubic convolution interpolated continuous function of the scaled data output from the forward scaling processor using a second scaling factor and restoring the scaled data into the original image data; and</u>

<u>a parameter optimizer optimizing the parameters using the original image data and the data restored into the original image data output from the backward scaling processor, and transferring the optimized parameters to the forward scaling processor and the backward scaling processor, respectively.</u>

2.   (Previously Presented) A cubic convolution interpolating apparatus comprising:

an image signal divider dividing an image signal into a plurality of subblocks as original image data; and

a generating unit generating parameters which determine cubic convolution interpolation coefficients in units of subblocks, and performing cubic convolution interpolation on the original image data,

wherein the generating unit comprises:

a forward scaling processor sampling a cubic convolution interpolated continuous function of the original image data transmitted from the image signal divider using a first scaling factor and scaling the original image data;

a backward scaling processor sampling a backward cubic convolution interpolated continuous function of the scaled data output from the forward scaling processor using a second scaling factor and restoring the scaled data into the original image data; and

a parameter optimizer optimizing the parameters using the original image data and the data restored into the original image data output from the backward scaling processor, and transferring the optimized parameters to the forward scaling processor and the backward scaling processor, respectively.

3.   (Original) The cubic convolution interpolating apparatus according to claim 2, wherein the parameter optimizer comprises:

a parameter variation detector detecting a parameter variation using the original image data and the restored data;

a parameter detector detecting an updated parameter using the parameter variation and a currently set parameter;

a parameter replacement determination unit determining whether the currently set parameter is to be replaced with the updated parameter; and

a parameter replacement and supply unit processing replacement of the currently set parameter with the updated parameter according to the determination result of the parameter replacement determination unit and supplying the updated parameter to the forward scaling processor and the backward scaling processor.

4.   (Original) The cubic convolution interpolating apparatus according to claim 3, wherein the parameter variation detector determines a quantity of lost information and the parameter replacement determination unit determines whether the currently set parameter is to be replaced using a difference between the total quantity of lost information of a previous frame

and the total quantity of lost information of a current frame.

5.   (Original) The cubic convolution interpolating apparatus according to claim 3, wherein the parameter replacement determination unit determines that the currently set parameter is to be replaced with the updated parameter if the operation result performed with respect to the total quantity of lost information of a previous frame and the total quantity of lost information of a current frame is greater than a predetermined threshold, the operation result given by:

$$\left\{ \sum_{\forall i} E_i' - \sum_{\forall i} E_i \right\} / \sum_{\forall i} E_i > \varepsilon_T$$

wherein $\sum_{\forall i} E_i'$ is the total quantity of lost information of a previous frame, $\sum_{\forall i} E_i$ is the total quantity of lost information of a current frame, and ε_T is the predetermined threshold.

6.   (Original) The cubic convolution interpolating apparatus according to claim 3, wherein the parameter replacement determination unit determines that the currently set parameter is to be replaced with the updated parameter using a difference between the quantity of lost information of the corresponding subblock in a previous frame and the quantity of lost information of the corresponding subblock in a current frame.

7.   (Original) The cubic convolution interpolating apparatus according to claim 3, wherein the parameter variation detector determines a quantity of lost information and the parameter replacement determination unit determines whether replacement with the updated parameter is to be done, if the operation result performed with respect to the quantity of lost information of the corresponding subblock in a previous frame and the quantity of lost information of the corresponding subblock in a current frame, is greater than a predetermined threshold, the operation result given by:

$$\{E_i' - E_i\} / E_i > \varepsilon_T$$

wherein E_i' is the quantity of lost information of the corresponding subblock in a

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previous frame, E_i is the quantity of lost information of the corresponding subblock in a current frame and ε_T is the predetermined threshold.

8. (Original) The cubic convolution interpolating apparatus according to claim 3, wherein the parameter detector detects the updated parameter by incrementing the parameter variation to the currently set parameter.

9. (Original) The cubic convolution interpolating apparatus according to claim 3, wherein the parameter variation detector determines a quantity of lost information and the parameter variation detector detects a parameter variation using the quantity of lost information of the corresponding subblock, the quantity detected by performing an operation with respect to the original image data and the restored data, as represented by:

$$E(\alpha) = \sum_{\forall k} \{f(x_k) - g(x_k)\}^2$$

wherein $E(\alpha)$ is the quantity of lost information of the corresponding subblock, $f(x_k)$ is the original image data, and $g(x_k)$ is the restored data.

10. (Original) A cubic convolution interpolating apparatus comprising:

a forward scaling processor sampling a forward cubic convolution interpolated continuous function of original image data using a first scaling factor and scaling the original image data;

a backward scaling processor sampling a backward cubic convolution interpolated continuous function of the scaled data output from the forward scaling processor using a second scaling factor and restoring the scaled data into the original image data; and

a parameter optimizer optimizing a parameter using the original image data and the data restored into the original image data output from the backward scaling processor, and transferring the optimized parameter to the forward scaling processor and the backward scaling processor, respectively.

11. (Currently Amended) A cubic convolution interpolating method comprising:

dividing an image signal into a plurality of subblocks once; and

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generating parameters which determine cubic convolution interpolation coefficients in units of the once divided subblocks, and performing cubic convolution interpolation on the plurality of once divided subblocks,

wherein the parameter generating comprises:

sampling a cubic convolution interpolated continuous function of original image data using a first scaling factor and forward scaling the original image data;

sampling a backward cubic convolution interpolated continuous function of the scaled data obtained in the forward scaling processing step using a second scaling factor and restoring the scaled data backward into the original image data;

determining and optimizing a parameter which determines the cubic convolution interpolation coefficient using the original image data and the data restored into the original image data by the backward scaling; and

supplying the optimized parameter to be used in the forward scaling and the backward scaling.

12.   (Original) A cubic convolution interpolating method comprising:

sampling a cubic convolution interpolated continuous function of original image data using a first scaling factor and forward scaling the original image data;

sampling a backward cubic convolution interpolated continuous function of the scaled data obtained in the forward scaling processing step using a second scaling factor and restoring the scaled data backward into the original image data;

determining and optimizing a parameter which determines the cubic convolution interpolation coefficient using the original image data and the data restored into the original image data by the backward scaling; and

supplying the optimized parameter to be used in the forward scaling and the backward scaling.

13.   (Original) The cubic convolution interpolating method according to claim 12, wherein the parameter optimizing comprises:

obtaining a quantity of lost information using the original image data and the restored data;

obtaining a parameter variation based on the quantity of lost information;

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obtaining a updated parameter using the parameter variation and a currently set parameter;

determining whether the currently set parameter is to be replaced with the updated parameter; and

replacing the currently set parameter with the updated parameter if the currently set parameter is to be replaced with the updated parameter.

14.   (Original) The cubic convolution interpolating method according to claim 13, wherein the obtaining of the quantity of lost information comprises obtaining a total quantity of lost information of a previous frame and a total quantity of lost information of a current frame; and

the parameter replacement determining comprises using a difference between the total quantity of lost information of the previous frame and the total quantity of lost information of the current frame to determine whether the currently set parameter is to be replaced with the updated parameter.

15.   (Original) The cubic convolution interpolating method according to claim 13, wherein; and

the obtaining of the quantity of lost information comprises obtaining a total quantity of lost information of a previous frame and a total quantity of lost information of a current frame; and

the parameter replacement determining comprises determining that the parameter is to be replaced with the updated parameter, if the operation result performed with respect to the total quantity of lost information of a previous frame and the total quantity of lost information of the current frame, is greater than a predetermined threshold, the operation result given by:

$$\left\{ \sum_{\forall i} E_i' - \sum_{\forall i} E_i \right\} / \sum_{\forall i} E_i > \varepsilon_T$$

wherein $\sum_{\forall i} E_i'$ is the total quantity of lost information of the previous frame, $\sum_{\forall i} E_i$ is the total quantity of lost information of the current frame, and ε_T is a predetermined threshold.

16.   (Original) The cubic convolution interpolating method according to claim 13,

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further comprising iteratively performing the parameter optimizing and the optimized parameter supplying until further replacement is no longer necessary.

17.   (Original) The cubic convolution interpolating method according to claim 13, further comprising dividing the original usage data into a plurality of subblocks prior to performing the cubic convolution interpolation.

18.   (Original) The cubic convolution interpolating method according to claim 17, wherein the obtaining the quantity of lost information is performed in units of subblocks.

19.   (Original) The cubic convolution interpolating method according to claim 17, wherein the updated parameter obtaining comprises incrementing the parameter variation to the currently set parameter.

20.   (Original) The cubic convolution interpolating method according to claim 17, wherein the parameter replacement determining comprises determining that replacement with the updated parameter is to be performed if the operation result performed with respect to the quantity of lost information of the corresponding subblock in a previous frame and the quantity of lost information of the corresponding subblock in a current frame is greater than a predetermined threshold, the operation result given by:

$$\{E_i{}'-E_i\}/E_i > \varepsilon_T$$

wherein $E_i{}'$ is the quantity of lost information of the corresponding subblock in the previous frame, E_i is the quantity of lost information of the corresponding subblock in the current frame and ε_T is the predetermined threshold.

21.   (Original) The cubic convolution interpolating apparatus according to claim 3, wherein the parameter variation detector determines a quantity of information of the original image data using the restored data, and detects the updated parameter when the quantity of lost information is a minimum.

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22.   (Original) The cubic convolution interpolating method according to claim 13, wherein the updated parameter obtaining comprises:

determining a quantity of information of the original image data using the restored data; and

obtaining the updated parameter when the quantity of lost information is a minimum.

23.   (Original) The cubic convolution interpolating apparatus according to claim 3, wherein the parameter replacement and supply unit determines whether a first value of a current one of the subblocks values equals a total value of the subblocks in one frame, wherein

if the first value equals a total value, the parameter replacement and supply unit determines whether the currently set parameter is to be replaced, replaces the currently set parameter with the updated parameter if the currently set parameter is to be replaced, and resets the first value to an initial value, and

if the first value does not equal a total value, the parameter replacement and supply unit increments the first value, and the forward scaling processor samples a cubic convolution interpolated continuous function of a next one of the subblocks.

24.   (Original) The cubic convolution interpolating apparatus according to claim 3, wherein the parameter replacement and supply unit determines whether the currently set parameter is to be replaced, wherein

the parameter replacement and supply unit replaces the currently set parameter with the updated parameter if the currently set parameter is to be replaced, checks whether a first value of a current one of the subblocks values equals a total value of the subblocks in one frame, increments the first value and then the forward scaling processor samples a cubic convolution interpolated continuous function of a next one of the subblocks, if the first value does not equal the current value, intializes the first value and then the forward scaling processor samples the cubic convolution interpolated continuous function of the next one of the subblocks, if the first value equals the total value;

the parameter replacement and supply unit increments the first value and then the forward scaling processor samples the cubic convolution interpolated continuous function of the next one of the subblocks, if the currently set parameter is not to be replaced and the first value equals the total value; and

the parameter replacement and supply unit checks whether at least one parameter for a corresponding one frame image has been replaced if the currently set parameter is not to be replaced and the first value equals the total value, and initializes the first value and then the forward scaling processor samples the cubic convolution interpolated continuous function of the next one of the subblocks, if the at least one parameter has been replaced.

25.   (Previously Presented) A cubic convolution interpolating apparatus used with an image signal, comprising:

a generating unit generating parameters which determine interpolation coefficients of the image signal according to a forward scaling and a backward scaling of the image signal each of the forward and backward scaling using a different scaling factor, wherein the generating unit comprises:

a parameter optimizer optimizing a parameter according to a local property of the image signal; and

a cubic convolution interpolator performing a cubic convolution interpolation on the image signal using the optimized parameter.

26.   (Previously Presented) A cubic convolution interpolating method for an image signal, comprising:

generating parameters which determine interpolation coefficients of the image signal according to a forward scaling of the image signal and a backward scaling of the forward scaled image signal;

optimizing a parameter according to a local property of the image signal; and

performing a cubic convolution interpolation on the image signal using the optimized parameter,

wherein a different scaling factor is respectively used for the forward scaling and the backward scaling.

27.   (Previously Presented) A cubic convolution interpolating method comprising:

dividing an image signal into a plurality of subblocks; and

generating parameters which determine cubic convolution interpolation coefficients in units of subblocks, and performing cubic convolution interpolation on the plurality of subblocks.

wherein the parameter generating comprises:

sampling a cubic convolution interpolated continuous function of original image data using a first scaling factor and forward scaling the original image data;

sampling a backward cubic convolution interpolated continuous function of the scaled data obtained in the forward scaling processing step using a second scaling factor and restoring the scaled data backward into the original image data;

determining and optimizing a parameter which determines the cubic convolution interpolation coefficient using the original image data and the data restored into the original image data by the backward scaling; and

supplying the optimized parameter to be used in the forward scaling and the backward scaling.

28.   (Original) The cubic convolution interpolating method according to claim 27, wherein the parameter optimizing comprises:

obtaining a quantity of lost information using the original image data and the restored data;

obtaining a parameter variation based on the quantity of lost information;

obtaining a updated parameter using the parameter variation and a currently set parameter;

determining whether the currently set parameter is to be replaced with the updated parameter; and

replacing the currently set parameter with the updated parameter if the currently set parameter is to be replaced with the updated parameter.

29.   (Original) The cubic convolution interpolating method according to claim 28, wherein

the replacing of the currently set parameter with the updated parameter comprises:

determining whether a first value of a current one of the subblocks values equals a total value of the subblocks in one frame, such that if the first value equals the total value, the currently set parameter is replaced if determined that the currently set parameter is to be replaced and then the first value is reset to an initial value and sampling a cubic convolution interpolated continuous function on the next one of the subblocks is performed, or if the first

value does not equal the total value, the first value is incremented, and sampling a cubic convolution interpolated continuous function on the next one of the subblocks is performed.

30.   (Original) The cubic convolution interpolating method according to claim 28, wherein

the replacing of the currently set parameter with the updated parameter comprises:

determining whether the currently set parameter is to be replaced;

replacing the currently set parameter with the updated parameter if the currently set parameter is to be replaced, checking whether a first value of a current one of the subblocks values equals a total value of the subblocks in one frame, incrementing the first value and then sampling a cubic convolution interpolation continuous function of a next one of the subblocks, if the first value does not equal the total value, or initializing the first value and then sampling the cubic convolution interpolated continuous function of the next one of the subblocks if the first value equals the total value;

incrementing the first value and then sampling the cubic convolution interpolated continuous function of the next one of the subblocks, if the currently set parameter is not to be replaced and the first value does not equal the total value; and

checking whether at least one parameter for a corresponding one frame image has been replaced if the currently set parameter is not to be replaced and the first value equals the total value, and initializing the first value and then sampling the cubic convolution interpolated continuous function of the next one of the subblocks, if the at least one parameter has been replaced.

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